



REPRESENTATIVE CHUCK BENEDICT

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Committee on Health, Human Services, Insurance, and Job Creation

Representative Chuck Benedict

December 18, 2007

I would like to express my thanks to Chair Erpenbach and the other members of the Senate Committee on Health, Human Services, Insurance, and Job Creation for holding this hearing regarding needle electromyography (EMG) studies. My bill, SB 175, states that only licensed physicians may perform and interpret needle EMG studies, and interpret the accompanying nerve conduction studies. Other appropriately trained personnel may perform the nerve conduction studies.

The EMG needle exam is a diagnostic procedure which is an important tool to help in the diagnosis of neuromuscular diseases, such as carpal tunnel syndrome, pinched nerves, and ALS or Lou Gehrig's Disease. It involves placing a sharp, sterile needle into a number of muscles, one at a time, to measure the electrical activity of the muscle to obtain information about the health of the muscle and the nerve which controls it. Most exams will test several muscles in a limb, and several limbs may be tested.

With rare exceptions, the EMG needle exam is performed in conjunction with nerve conduction studies, which involves surface electrical stimulation of peripheral nerves and the subsequent measurement of the nerve's response, both the speed of signal conduction and its amplitude. These studies can indicate if a nerve is healthy and can detect focal pressure on a nerve, such as at the wrist or elbow.

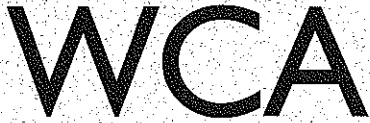
The EMG needle exam and nerve conduction studies are not "stand-alone" tests. They are part of a diagnostic evaluation which includes a medical history, physical exam, neurological exam as well as possibly blood tests and imaging tests. The entire evaluation leads to a diagnosis and therapeutic recommendations which can vary widely, from rest to surgery, and may include medications, physical therapy, work-hardening, and possibly referrals to additional physicians trained in other specialties.

Although the nerve conduction studies may be performed by trained non-physicians, the studies should only be interpreted by a physician, whose training includes a thorough understanding of the nervous system and the medical conditions that can interfere with healthy nerve functions.

The EMG needle exam should only be performed by a physician. The reason for this is that it is an "on-line" test. It must be interpreted as it is being performed, and the test continuously modified based on the preceding and ongoing results. These are medical decisions based upon years of training and experience. Once the EMG needle exam and nerve conduction studies are done, the resulting information is combined with the other information mentioned earlier to arrive at a clinical diagnosis and therapeutic recommendations.

Diagnosing and caring for patients with injuries or neuromuscular diseases is a true challenge and serious responsibility. That is why neurologists and physiatrists undergo four years of medical or osteopathic school and four years of residency after graduation from college. And this is why I believe that for optimal patient care only a licensed physician should perform and interpret needle EMGs.

I would be happy to take questions.



Wisconsin Chiropractic Association

521 E. Washington Avenue

Madison, WI 53703

Tel. (608) 256-7023 • Fax (608) 256-7123

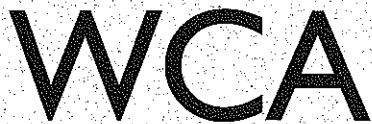
Anti-Discrimination / Insurance Equality Provisions

632.87(3)(A) No policy, plan or contract may exclude coverage for diagnosis and treatment of a condition or complaint by a licensed chiropractor within the scope of the chiropractor's professional license, if the policy, plan or contract covers diagnosis and treatment of the condition or complaint by a licensed physician or osteopath, even if different nomenclature is used to describe the condition or complaint. Examination by or referral from a physician shall not be a condition precedent for receipt of chiropractic care under this paragraph. This paragraph does not:

1. Prohibit the application of deductibles or coinsurance provisions to chiropractic and physician charges on an equal basis.
2. Prohibit the application of cost containment or quality assurance measures to chiropractic services in a manner that is consistent with cost containment or quality assurance measures generally applicable to physician services and that is consistent with this section.

(b) No insurer under a policy, plan or contract covering diagnosis and treatment of a condition or complaint by a licensed chiropractor within the scope of the chiropractor's professional license, may do any of the following

1. Restrict or terminate coverage for the treatment of a condition or a complaint by a licensed chiropractor within the scope of the chiropractor's professional license on the basis of other than an examination or evaluation by or a recommendation of a licensed chiropractor or a peer review committee that includes a licensed chiropractor.
2. Refuse to provide coverage to an individual because that individual has been treated by a chiropractor.
3. Establish underwriting standards that are more restrictive for chiropractic care than for care provided by other health care providers.
4. Exclude or restrict health care coverage of a health condition solely because the condition may be treated by a chiropractor.



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Chiropractic Scope of Practice

The practice of chiropractic is the application of chiropractic science in the adjustment of the spinal column, skeletal articulations and adjacent tissue which includes diagnosis and analysis to determine the existence of spinal subluxations **and associated nerve energy expression** and the use of procedures and instruments preparatory and complementary to treatment of the spinal column, skeletal articulations and adjacent tissue. Diagnosis and analysis may include physical examination, specimen analysis, drawing blood, blood-analysis and the use of x-ray and other instruments.



Wisconsin Medical Society

Your Doctor. Your Health.

TO: Members, Committee on Health, Human Services, Insurance, and Job Creation
Senator Jon Erpenbach, Chairperson

FROM: Mark Grapentine, JD – Senior Vice President, Government Relations
Jeremy Levin – Government Relations Specialist

DATE: December 18, 2007

RE: **Support** for Senate Bill 175 -- Needle Electromyography

On behalf of the Wisconsin Medical Society's more than 11,000 members, thank you for this opportunity to testify in support for Senate Bill 175, relating to the practice of needle electromyography (EMG), nerve conduction studies and surface electromyography. We would especially like to thank the bill's authors Senator Erpenbach (D-Middleton) and retired neurologist Representative Chuck Benedict, MD (D-Beloit). As one who performed numerous needle EMG procedures, Dr. Benedict is the Legislature's expert in this area.

Needle EMGs are very technical procedures that physicians – particularly neurologists and physical medicine and rehabilitation physicians – spend four years of medical school and at least another four years in a post-graduate residency learning and performing thousands of needle EMGs prior to practicing independently. The procedure involves an invasive, diagnostic medical tool used to diagnose conditions such as Lou Gherig's Disease and carpal tunnel syndrome where the illness involves a lack of proper muscle function that a physician can test with the insertion of a needle into the patient's affected muscle area. The test requires the physician to perform and interpret the results in "real time" to determine what muscles to test to ultimately make the proper diagnosis.

Other health care professionals claim they have the ability and training to perform a needle EMG. While their educational training is not as extensive as a neurologist or physical medicine and rehabilitation physician, performing the test is only a portion of the needle EMG procedure. Any test results performed by a non-physician health care provider would require a patient to be subjected again to the painful and costly procedure by an appropriately trained physician to validate previous testing methods and interpret the results in "real time" to make the proper diagnosis, and determine the correct course of treatment. Additionally, Wisconsin laws governing the practice of medicine are specific to the diagnosis of medical conditions as well as performance of invasive procedures. References to diagnoses in the statutes contain similar specific titles (i.e. "chiropractic diagnosis" in s. 460.01(4)) or limiting language (s. 448.50(1r), definition of "diagnosis" for physician therapists specifically excludes "medical" diagnosis). Therefore, the Society believes that SB 175, which limits the performance and diagnosis of needle EMGs to physicians, conforms with current law and the practice of medicine.

Based in large part on the current laws related to diagnosis and the sophistication of needle EMG, the Society has clear policy bolstering our strong support for SB 175 as drafted:

SCO-015

Electrodiagnostic Medicine: The Wisconsin Medical Society affirms that performing needle electromyography is the practice of medicine, and work to discourage other non-physician health care professionals from expanding their scope of practice to include performing needle electromyography.

The Wisconsin Medical Society works to discourage physicians from interpreting needle electromyographic studies that they did not actually perform, through methods including CPT coding modifiers to create a distinction between needle EMGs performed by a physician and those performed by another provider, even if later interpreted by a physician, and discouraging reimbursement for needle electromyography that was not actually performed by a physician. (HOD 0406)

As our policy plainly states, physicians consider needle EMG within the practice of medicine, and only physicians should perform this complex procedure. The Society's policy also concurs with the state's Medical Examining Board (MEB), which registered its opinion on needle EMG with the Legislature last session. At their November 9, 2005 meeting, the MEB stated that needle EMGs be "performed only by trained physicians who are licensed by the Medical Examining Board." Attached is the MEB's letter to the Chiropractic Examining Board.

Thank you for your consideration. If you have any further questions or need additional information, please feel free to contact Mark Grapentine (markg@wismed.org) or Jeremy Levin (jeremyl@wismed.org) at (608) 442-3800.

Jim Doyle
Governor

**WISCONSIN DEPARTMENT OF
REGULATION & LICENSING**

Celia M. Jackson
Secretary



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November 14, 2005

MS WENDY HENRICHS
VICE CHAIR
CHIROPRACTIC EXAMINING BOARD
1400 EAST WASHINGTON AVENUE
MADISON WI 53708-8935

Dear Ms. Henrichs:

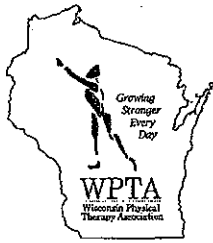
The Medical Examining Board met on November 9 and considered 2005 Senate Bill 394, relating to electromyography, after being briefed on the status of the bill draft.

The Board passed a motion opposing the bill and asked that I communicate to you that the Board passed a motion in favor of needle and surface electromyography being performed only by trained physicians who are licensed by the Medical Examining Board and that the chiropractors who are currently practicing needle or surface electromyography should cease immediately.

Sincerely,

Dr. Alfred Franger
Chair, Medical Examining Board

- c: The Honorable Carol Roessler
Wisconsin State Senator
- c: Ms. Alice O'Connor
American Association of Neuromuscular and Electrodiagnostic Medicine



Wisconsin Physical Therapy Association

A CHAPTER OF THE AMERICAN PHYSICAL THERAPY ASSOCIATION

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To: Members of Senate Committee on Health, Human Services, Insurance, and Job Creation

From: Rob Worth, President, Wisconsin Physical Therapy Association

Re: Opposition to SB 175

Date: December 18, 2007

Dear Members of the Committee:

We are here today to express the Wisconsin Physical Therapy Association's opposition to SB 175. This legislation would limit the scope of practice of physical therapists in the state for no justified reason other than to place a monopoly upon a procedure that physical therapists have been performing without incident for decades.

After you have waded through all the different arguments that proponents of the legislation will set forth, we feel confident that you will agree this legislation is unnecessary. It only hurts the patients of the state of Wisconsin by taking away the option of having a physical therapist perform this procedure and thus eroding patient choice.

- Physical Therapists have been performing needle EMG for decades without incident or any documented harm to a patient. We challenge proponents of the legislation to show where there are any incidents otherwise.
- PTs that perform needle EMG have completed a 2,000 hour post-graduate program provided and monitored through the American Board of Physical Therapy Specialties. 500 of these 2,000 hours are actual supervised performance of the procedure. At the end of this specialization process that usually takes years, the PT must sit for a board & practical examination.
- Although there are currently no PTs performing needle EMG in Wisconsin, there are 150 PTs nationwide who are certified. If this legislation were to pass, these PTs, and any future PTs, would not be able to perform an area of their practice that they have been doing so for decades without incident. Jeff Damaschke, a Lieutenant Commander in the United States Navy, who was unable to be here with us today, is currently stationed at the Great Lakes Naval center and resides in Kenosha. He will be fulfilling his military service

in the upcoming year and wishes to practice needle EMG in the state after his service. He practiced needle EMG in the Navy, is in the process of completing the ABPTS specialization program and wishes to practice needle EMG in Wisconsin. If this legislation were to pass, you would be giving him no choice but to go to another state to practice. Given the current state of health care, we know this committee does not want to drive good, hard working & qualified health professionals out of the state.

- If this legislation were to fail, PTs would not all stand up and start performing needle EMG. All 150 PTs in the nation perform needle EMG only upon direct referral from a physician. The claim that physicians need this legislation in order to prevent patient harm and misdiagnosis from PTs arbitrarily performing needle EMG is simply not true. The physician retains complete control over who performs the procedure. The process for doing so is that a physician sees a patient, suspects or wants to disprove a theory by using needle EMG. The physician then chooses who to refer the patient to, whether that is him or herself, another physician, or a physical therapist. When a referral is made to a PT, the PT performs the procedure, compiles the results, and sends the results back to the referring physician for him or her to make a medical diagnosis. A diagnosis is not made by the PT, nor is one able to be made simply from the procedure. The results of a needle EMG need to be compiled along with the physician's exam, other lab testing, and patient history and symptoms. To say that the patient would be harmed by a PT missing a medical diagnosis during the procedure is again simply not true.

For these reasons, the Wisconsin Physical Therapy Association and its 1600 plus members in the State urge you to oppose SB 175. Our opposition is to protect a scope of practice for qualified physical therapists that choose to specialize in needle EMG and at the same time preserve patient and doctor choice.

Thank you,

Robert Worth, PT, MSC, OCS, MTC, LAT
President
Wisconsin Physical Therapy Association

Paul E. Barkhaus, MD
Professor of Neurology
Medical College of Wisconsin
December 18, 2007

Needle Electromyography

My background: I have 29 years experience in EMG. I am a Board Certified Neurologist. I also am Board Certified through the American Board of Electrodiagnostic Medicine. I have done one year of full time training in EMG, with an additional 1.5 years in EMG research at Duke University and Uppsala University in Sweden. I am a Professor of Neurology at the Medical College of Wisconsin and the Director of the Clinical Neurophysiology Training Program in Neurology there which is ACGME approved. I also am the Director of the Amyotrophic Lateral Sclerosis Clinical Program. I have over 25 research articles in peer-reviewed journals, mostly in EMG and in over half I am the first author. These have been cited several hundred times in other research articles and textbooks. In addition, I have approximately 15 books, book chapters, and other educational publications in EMG. I do teaching in EMG workshops at national and international meetings. Currently I am also on a national task force reviewing quantitative needle EMG.

Needle Electromyography (EMG): Needle EMG is the study of the integrity of the electrical signal that the muscle generates when it is activated or contracted, or by reflex when the nerve supplying the muscle is stimulated. In the normal state, the muscle generates a signal, the motor unit action potential. This signal becomes altered or abnormal in disease states, for example primary disorders of muscle fibers, neurogenic processes where the nerve supplying the muscle is impaired, or diseases when the connection between the nerve and the muscle (the synapse) become impaired. The muscle studied may range from those of the limbs (ie, arms and legs), to those of the paraspinal muscle, facial muscles, laryngeal muscles, and muscles of the pelvic floor. I should also add that nerve conduction studies are also typically performed. The two studies together are utilized in a complimentary way to reach an electrodiagnostic conclusion. The instrument used to perform these studies is referred to as an electromyograph, which is a sophisticated machine that is computer-based, but also includes special amplifiers, digital displays, trigger/delay lines, stimulators, etc.

I emphasize that needle EMG is not the same as an EKG for the heart. In the latter instance, a technician may perform the procedure as it is performed in a rote manner. Of course interpreting the EKG is performed by a medical physician trained in the procedure. In contrast, needle EMG varies depending on the clinical problem. In some cases, only a few muscles need be studied, in other situations, a more extensive study may be required. Therefore one must work under an economy of studying the fewest muscles needed to yield an appropriate diagnosis, yet perform an adequate study. Needle EMG, like most all medical procedures, are also not trivial in cost.

Surface Electromyography (EMG): Surface EMG differs from needle EMG in that it is a non-invasive study of the muscle signal using disc electrodes taped to the surface of the skin. It is not used clinically for diagnosis because of the limitations of the technique in isolating the muscle signal it is trying to record from. It may be suitable for therapeutic purposes such as biofeedback when detailed analysis of the individual motor units is not needed.

Specialists who are qualified to perform needle EMG: For medical doctors and osteopathic physicians, training in needle electromyography is generally within the two specialties of neurology and physical medicine and rehabilitation (also known as Physiatry). The ACGME (American Council on Graduate Medical Education), in conjunction with the respective specialty boards, stipulates how medical school graduates are trained in these specialties. This includes all aspects of their training including what, where, duration of training, and by whom. Not all physiatrists and neurologists may perform electrodiagnostic procedures such as needle electromyography as part of their practice. In each specialty, there is a minimum of full-time training under direct supervision in electrodiagnostic medicine. This means that the trainee is essentially one-on-one with a Board Certified Faculty person in that specialty. Additional certifications can be obtained. The American Board of Psychiatry and Neurology offers a fifth year of training in Clinical Neurophysiology that includes EMG. The American Board of Electrodiagnostic Medicine offers certification to MD or DO applicants that have completed 6 months minimum of full-time training in EMG. In both cases, candidates are certified upon successfully passing a Board Examination. I would refer anyone to their website for specific details, which are carefully documented and outlined. I personally am a member of the Examination Committee for the American Board of Electrodiagnostic Medicine, and spent this past weekend working on the digital waveform and clinical videos for this examination.

Risks in performing needle EMG: We should really begin with whether an invasive procedure that typically causes at least minimal to moderate discomfort for most individuals is appropriate for that particular patient. That should be determined by the medical physician who is treating the patient, as well as the clinical neurophysiologist who is going to perform the study.

Other risks include patient with bleeding problems, vulnerable areas of skin where a small pinprick through the skin may result in an ulceration, to damage to neural or other structures. Standard precautions need to be observed, with particular reference to transmissible diseases such as HIV, Jakob-Creutzfeldt (pronounced "Yock-ub- Kroytz-feldt). I need not remind this committee of the debacle that may result when risk of exposure occurs even under the best of controlled circumstances such as happened last week in Milwaukee. In doing the test the electrodiagnostic consultant is assuming the responsibility for rendering a diagnostic interpretation or impression and not deferring this to the referring physician. If the latter is erroneous, it may lead to additional testing that may not be indicated or treatment to the patient that may not be appropriate (and

hopefully not injurious). Finally, is the economic burden to the patient, who may be responsible for the payment of a test that was not indicated or in having a repeat test performed if the initial one was erroneous or inappropriate.

My concerns in allowing non-medical/osteopathic physicians perform needle EMG:

1. There is a perception that an EMG is, like I mentioned above, a rote procedure like an EKG where electrodes are placed in a standard position and a recording made of passive biological phenomena like the heart beat. EMG is quite dynamic, and requires that the electrodiagnostic consultant know the differences between the signals generated between various muscles, variations in normal, and when pathology is present- which in many cases may be subtle. Thus the impression that an electromyographer is like a phlebotomist drawing blood is wrong. To further analogize, the phlebotomist draws the blood and that's all. The interpretation of the test is performed by a clinical pathologist. In EMG, the electrodiagnostic consultant is performing the study which is technical in part, but also analyzing and interpreting findings as they study each insertion site. This means that the EMG study may likely be modified significantly as the study is performed.
2. I have no problem taking referrals from chiropractors. But they understand that they refer a patient to me for an initial consultation, not an EMG. If I feel an EMG is indicated, then I will proceed with the testing. A neurological consultation is far cheaper than an EMG. In 17 years experience reviewing hundreds of medical files, I have seen a large number of cases where chiropractors are involved with the patient's care. It is clear to me from their documentation that they do not understand what they are ordering, nor do they know what to do with the information in applying it to the patient's care. The point made in a previous hearing that this helps patients access healthcare is simply untrue. Furthermore, let me tell me about a colleague who is a nurse and a chiropractor who needed an EMG. It may be telling that despite ample access to local chiropractors doing EMG and at great inconvenience to her, she sought me out and asked that I perform it. Finally, I have visited chiropractor's offices in past and have found that some were still using a metal "pinwheel" to test sensation. This device is of historical interest only and has long been abandoned by every physician because of the risk of transmissible infectious agents. If something as basic as a tool for the clinical examination is mis-used, what should we expect if they were responsible for sophisticated medical procedures such as EMG?
3. I have reviewed the website for Chiropractic Neurology and it states that the minimum training requirements are 300 hours instruction in "neurology". Based on a 30 hour estimated full time instructional week, this means 10 weeks of

training for neurology in general. The requirements also state that the areas of training emphasis should be periodically (every 5 years) based on a job analysis survey. In reviewing the job survey, I am dismayed to learn that this not only

includes spinal conditions, but also disorders of the central nervous system like Parkinson's Disease, epilepsy, and other disorders that require medications that they are not qualified to prescribe. To then add in a diagnostic procedure that medical physicians spend more than twice that amount of time to obtain basic proficiency simply defies credibility. Chiropractors are not medical doctors: they do not order laboratory tests or prescribe medication other than for over-the-counter supplements.

4. Physical Therapists allegedly have training programs in performing EMG. To date I have not seen anything produced other than what I had read on a website for training in EMG. While there is didactic instruction, the actual hands-on training is nebulous in the form of workshops. I am aware of only one textbook on EMG written by a PT which is more of a technical manual than a textbook. I find a number of errors in the book, and interestingly the glossary of terms in it is taken directly from the American Association of Neuromuscular and Electrodiagnostic Medicine's "Glossary of Terms". Every reference in the book is a book of electrodiagnostic medicine used by medical doctors. Let us examine their title, "Physical Therapist". I believe the term "therapist" means just that, therapy- not diagnosis. I also caution that there has been some attempt to obscure the issue of *needle EMG* with *surface EMG*. The latter is a reasonable therapeutic modality used by PTs which is not at issue here. In a past presentation, the PTs brought in a neurologist from Pennsylvania who testified that his training in EMG was suboptimal while a resident. This is not the issue here- namely the quality of his training program. Nor was his associate, a PT who claimed to have performed several thousand EMGs over a number of years. The number he offered would rival my number and I am doing them in a tertiary care institution. I find this number startling for a PT associated with a general neurology private practice group. When asked what he did when confronted with a problem doing EMGs, I found it curious that he said he went to ask advice from the neurologists he works for, including the one who claimed to have suboptimal training to begin with. I don't think this makes much sense except to say that 1) this group would seem to be doing a large number of EMG studies for what they described to be a general neurology practice group and, 2) the physicians are using a PT to be essentially a technician to do their studies. In my opinion this is wrong and a misallocation of medical resources. We do not want that to happen in Wisconsin.

5. When one is certified to perform an electrodiagnostic procedure, one is certified as just that. The electrodiagnostic consultant is expected to know the various patterns of abnormalities possible. Chiropractors and Physical Therapists are not physicians. I do not understand how two groups (Chiropractors and PTs), whose main role is in treating soft tissue injuries, assume that they have the expertise to diagnose potentially serious medical conditions. The argument that they would practice within the scope of their practice and that they know what they don't know in dealing with complex diagnostic problems is illogical and wrong! You are aware of Dr. Timothy Dillingham's papers that demonstrated one condition, polyneuropathy, was significantly under-diagnosed by both chiropractors and PTs. In such circumstances, a lot of patients are going to be delayed in getting appropriate testing and therapy.
6. As a member of a national task force in EMG, we are reviewing over 2400 articles on EMG derived from a computerized search of the scientific literature. Although the authorship of the articles is not our specific charge, I have not found any article written by either a chiropractor or a PT. To my knowledge, all of the relevant research and clinical literature in EMG has been done by physicians or Ph.D. scientist collaborating with physicians.
7. There is no shortage of physician electrodiagnostic consultants to justify increasing the number of individuals doing EMG.

Members of the Health Care Committee, I thank you for your time and ask that you to do the right thing and support this bill in the interests of the citizens of Wisconsin. I am not here to proselytize for a "fence them out" policy, sort of a protectionism mentality. Chiropractors and PTs have a role in health care, but it is not in doing medical procedures. Specifically with respect to electromyography, they were never there in the first place developing it or doing it. I am here to try to inform you what the issues are regarding a medical procedure which historically has been developed and continues to have research done in it by physician clinical neurophysiologists, who apply it to medical problems. To have other non-physician groups assert that they possess the expertise to in essence practice medicine by way of performing electrodiagnostic medicine is simplistic and a disservice to the citizens of this state, not only in diluting the quality of healthcare, but also in containing its costs. Thank you for your time and attention.



December 18, 2007

Senator Jon Erpenbach
Chair, Committee on Health & Human Services
Room 8 State Capitol
State Capitol
PO Box 7883
Madison WI 53707

RE: December 18, 2007 Public Hearing on Senate Bill 175

Dear Senator Erpenbach:

As a University of Wisconsin School of Medicine and Public Health Professor of Neurology and Immediate Past President of the Wisconsin Neurological Society, I would like to express my support for Senate Bill 175.

As you know, this bill will improve Wisconsin's standards for needle electromyography (EMG) and nerve conduction studies (NCS) by requiring that these diagnostic medical exams only be appropriately performed and interpreted by a physician.

Needle EMG and NCS are studies performed by physicians to examine a patient's muscles and nerves. The procedures are employed by physicians to diagnose maladies ranging from carpal tunnel syndrome to life threatening diseases like Lou Gehrig's disease. During an electrodiagnostic consultation that includes both EMG and NCSs, the physician uses his or her medical school and residency training to determine what muscles should be studied. Throughout performance of the needle EMG and NCS evaluation, physicians use information from the studies being performed to determine which disorders can be ruled out and what further muscles must be examined to reach a final diagnosis. Diagnostic decisions are made throughout the examination. After the study, the physician combines the results of the needle EMG and NCSs with other information such as the history and physical examination to determine a diagnosis and treatment plan. Some nonphysicians believe they are capable of performing these studies. They view them as a simple procedure that a physician can interpret later. This is an inaccurate assessment of these tools. Properly performed, these tests require medical decision making, which is the practice of medicine.

Passing this legislation will prevent redundant studies and ensure accurate diagnoses, conserving scarce health care dollars. As you are aware, health care costs have soared in the last decade. To keep costs under control, it is critical that only necessary tests are performed and the right diagnosis reached. Health care dollars are wasted when unnecessary tests are performed, when trained physicians need to repeat studies performed by nonphysicians, or when surgeries are conducted based on inaccurately interpreted electrodiagnostic studies.

Thank you again for this opportunity to share my expert opinion on this legislation. I hope the Committee will see fit to approve this legislation in the near future so the full Assembly can pass it during this legislative session.

Sincerely,

Andrew J. Waclawik, MD, FAAN, FAANEM

Professor of Neurology,
University of Wisconsin School of Medicine and Public Health
Immediate Past President, Wisconsin Neurological Society

cc: Senate Committee on Health, Human Services, Insurance and Job Creation

Jim Doyle
Governor

WISCONSIN DEPARTMENT OF
REGULATION & LICENSING



Celia M. Jackson
Secretary

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December 13, 2007

To: Senate Committee on Health, Human Services, Insurance and Job Creation
Senator Jon Erpenbach (Chair)
Senator Kathleen Vinehout (Vice Chair)
Senator Tim Carpenter
Senator Lena Taylor
Senator Carol Roessler
Senator Mary Lazich

Re: 2007 SB 175

From: Wisconsin Chiropractic Examining Board
Steven Silverman, D.C., C.C.S.T. (Chair)
Wendy M. Henrichs, B.Sc., D.C., D.L.C.C.P. (Vice Chair)

Dear Members of the Senate Committee on Health, Human Services, Insurance and Job Creation:

The Chiropractic Examining Board, at its June 15, 2007 meeting, reviewed 2007 SB 175 and its companion AB 325, and by unanimous vote, opposed the passage of both bills. It is the position of the Chiropractic Examining Board that the proposed bills are in direct conflict with the Board's existing policy on Needle Electromyography (NEMG).

In June 2002, the Chiropractic Examining Board took the following position on NEMG:

Doctors of Chiropractic may utilize NEMG for diagnostic purposes. NEMG equipment may be operated only by a chiropractor who has the education, training, and experience necessary to be eligible for, or has been admitted to, diplomate status by the American Board of Chiropractic Neurology (DABCN or DACNB). The American Chiropractic Association (ACA) recognizes the American Chiropractic Neurology Board as the sole authority in credentialing in Neurology for the Chiropractic Profession. The ACNB diplomate program in neurology certification is fully accredited by NOCA/NCCA.

There are fewer than 12 out of 1650 licensees who have taken the necessary education to perform NEMG.

The Chiropractic Examining Board respectfully requests you consider the following prior to making any decision on SB 175.

- The Chiropractic Examining Board was created in 1925 when chiropractors were first licensed. To the best of our institutional knowledge all prior issues relating to scope of practice had been deferred by prior legislative committees to our board. Senate Bill 175 along with its companion bill is the first instance in memory that a legislative proposal has attempted to impose a legislative opinion on our board regarding a technical scope of

practice or education issue. This attempt is especially troubling as it is in direct opposition to our existing 5-year-old position on this issue.

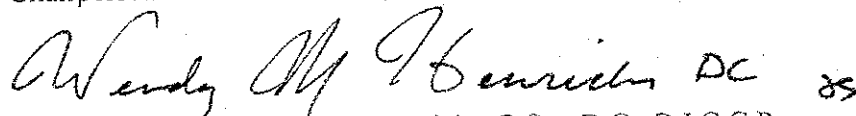
- Proponents of both bills have been very vocal on their claim that this bill is necessary for safety of the public compliance. However, our records show zero complaints on a Chiropractic Diplomate utilizing NEMG.
- Our records show zero instances of chiropractors who have been found to provide NEMG without the post-graduate education as required by the Chiropractic Examining Board. We note that the Medical Examining Board does not have an equivalent requirement for medical physicians who wish to perform NEMG. It is possible for a licensed physician to perform a NEMG study with no training whatsoever specific to the procedure.
- During our deliberations prior to the development of our current policy, the Chiropractic Examining Board reviewed the technical criteria for the performance of NEMG by chiropractors. The board, at that time, was satisfied that the education requirements imposed as a precondition for chiropractic neurologists to perform NEMG were fully sufficient to protect the public. We have seen no evidence to believe that a change in our policy is warranted.
- The chiropractic scope of practice specifically refers to "abnormal nerve impulse" which is measured by the NEMG.
- We agree that only trained portal of entry professionals that are able to Diagnose should be allowed to provide these services. The Chiropractic Examining Board believes that its current policy coupled with the high underlying educational base of licensed Chiropractors provides substantial public protection.
- We also welcome any Board that has concerns with the safety of the public to contact us first to open lines of communication before pursuing legislative avenues.

We would like to thank the committee for thoughtfully considering our position on SB 175. We offer our availability for any discussion you wish to have regarding our position.

Respectfully Submitted,

 Steven Silverman D.C.

Chairperson Steven Silverman, D.C., C.C.S.T.

 Wendy M. Henrichs D.C.

Vice Chairperson Wendy M. Henrichs, B.Sc., D.C., D.I.C.C.P.

Cc: Secretary Celia M. Jackson, Secretary - Department of Regulation and Licensing
Executive Assistant, Larry Martin - Department of Regulation and Licensing

To: Senate Committee on Health, Human Services, Insurance, and Job Creation
Senator Jon Erpenbach, Chair

From: Donn Dexter, MD
Chair, Department of Neurology,
Luther Midelfort, Mayo Health System

Date: December 18, 2007

Re: Senate Bill 175, Needle EMG

I am writing in support of Senate Bill 175, Needle EMG. In my capacity as a board certified neurologist I am very familiar with this procedure and I understand the importance and difficulty in performing this clinical test. I strongly believe that this test should be performed only by persons with extensive training in clinical neurophysiology.

This is a test that requires operator expertise and interpretation. This level of skill is obtained only with rigorous training and extensive clinical experience.

In our group, all the neurologists have received training in EMG and are licensed to perform this testing. We have agreed, however, to limit the performance of this testing to a subset of our group. In this way the quality of testing will remain high and the providers performing this testing will develop a higher level of expertise. Many groups are not able to make this commitment to quality care due to the higher level of reimbursement for this form of testing. Our integrated system allows us to allocate resources based on need and skill of provider rather than degree of reimbursement.

Tests performed by non-expert personnel may be of substandard quality and are very likely to be repeated, thus increasing the cost and complexity of care. If the testing is not repeated the results could possibly be erroneously included in the evaluation of patients leading to errors in patient treatment.

It is my strong belief that EMG needle examination of patients should be restricted to personnel with the minimum of training required by the American Academy of Neurology. In this way costs of patient care and patient safety will be best served.



December 18, 2007

Senator Jon Erpenbach
Senate Committee on Health & Human Services
330 Southwest
State Capitol
Madison, WI

RE: Public Hearing on SB 175

Chairman Erpenbach, Vice-Chair Vinehout, and Committee Members, I appreciate the opportunity to testify at this hearing regarding the proper performance of electrodiagnostic studies, specifically needle EMG and nerve conduction studies. I would like to begin by thanking Senator Erpenbach for his progressive thinking on this issue, and his sponsorship of proactive legislation that will protect the citizens of Wisconsin from substandard medical care. Quality medical care is a serious concern around the country and impacts all aspects of healthcare. According to the Institute of Medicine's report on medical errors, there are between 44,000 and 98,000 errors that cause deaths in American Hospitals each year. I sit before this committee and ask that you don't allow substandard performance of needle electromyography and interpretation of nerve conduction studies to be the cause of harm to any of any citizen of Wisconsin. This committee's awareness of this issue and the appropriate solution allows it to prevent any future harm.

I am Megan Fogelson, Director of Health Policy for the American Association of Neuromuscular and Electrodiagnostic Medicine—AANEM. I am here today representing the AANEM. We are a nonprofit organization that represents physicians that perform electrodiagnostic studies—specifically needle electromyography (EMG) and nerve conduction studies (NCSs).

Senate Bill 175 will protect the citizens of Wisconsin by requiring a medical license to perform needle EMG and to interpret nerve conduction studies. Physicians are extensively trained through 4 years of medical school, 4 more years of residency training and in many cases an additional year of fellowship training. During electrodiagnostic testing, the physician's medical school and residency training is used to determine what EMG or nerve conduction studies are needed before and during the test. Physicians make diagnostic decisions throughout the test and then compile everything they have learned to determine a diagnosis.

In contrast, chiropractors receive minimal or no exposure to electrodiagnostic testing in chiropractic training programs. Review of the curriculum at the National University of Health Sciences in Lombard, IL—one of two programs in the US accredited by the chiropractic Commission on Accreditation of Graduate Education in Neurology—found one course in neurology in the D.C. program with no mention of EMG or NCSs in its description.

DX6314 Neurology - 3.5 Credits

This course presents a study of the procedures of the neurological history and examination, clinical correlation of neurological findings with other clinical data, an introduction to functional neurology, and the application of manipulation, massage, exercise, and other sensory input in the management of patients with neurological disorders. Methods of instruction include lecture, patient video presentations and clinical cases presented in a large group. Small group and self-directed learning activities outside of class include specific readings about neurological diseases/disorders and written assignments based on the readings.

Chiropractors seeking certification in chiropractic neurology can earn credits hours at weekend, fly-in

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Executive Director
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seminars rather than the formalized training a medical resident or fellow receives. The AANEM was disturbed by the prominent display of the reimbursement for the studies, or CPT codes for the procedures matching the course titles in a flyer published by the National University of Health Science for its 150 hour training program in EMG, NCS and Evoked Potentials. This is an advertising technique that allows potential participants to evaluate the reimbursement levels available for these CPT codes prior to signing up for the courses. The AANEM believes that electrodiagnostic testing should be performed only when necessary and to the benefit of the patient's care. The American Board of Chiropractic Neurology requires 300 hours of training in neurology. There is no outline provided for the training is required. In contrast, the University of Wisconsin-Madison's training program for physical medicine and rehabilitation residents is very specific and articulates the entire course of training over a 4 year period. This is true for every medical training program in the United States as required by the American Council on Graduate Medical Education.

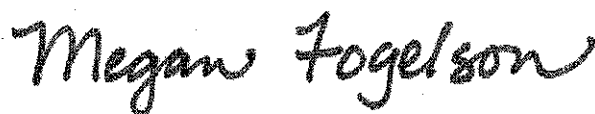
Similar to chiropractors, physical therapists receive minimal to no exposure to electrodiagnostic testing during M.S. or Ph.D. training. At the University of Wisconsin, students in the physical therapy program receive an informational lecture so they are aware of the testing and its application to diagnosis. A review of curriculum at other top-ranked physical therapy schools produced no coursework in this area. Dr. Salvi, who presented the informational lecture in the past, was unable to attend the hearing today, but he has testified previously that his lecture in no way qualifies students to perform electrodiagnostic studies on their own.

The American Board of Physical Therapy Specialties certification examination in Clinical Electrophysiology requires evidence of 2,000 hours of direct patient care in the specialty area within a 10-year time frame. The hour requirements are specific only to direct patient care, with no specific requirements for the education required of physical therapists seeking certification. Applicants are required to submit patient reports and testing logs. The AANEM does not believe that this standard for training is sufficient to ensure quality patient care.

Dr. Timothy Dillingham is the Chairman and Professor of PM&R at the Medical College of Wisconsin and is a 16 year member of the AANEM. Dr. Timothy Dillingham's most recent research examined the effectiveness of physicians versus non-physicians such as physical therapists. In patients with known diabetes that received a needle EMG and NCS, he examined how often physicians versus physical therapists stated that a patient had a patient diagnosis of polyneuropathy. Dr. Dillingham found that PM&R physicians, osteopathic physicians and neurologists were very consistent and diagnosed the patients with polyneuropathy in identical percentages statistically. In contrast, physical therapists recognized patients as having polyneuropathy only 2.1% - a rate about one-sixth that of physiatrists and neurologists despite controlling for differences in the types of patients seen. Chiropractors failed to diagnose anyone with polyneuropathy. In summary, this quality of care study demonstrated that non-physicians underrecognized this important comorbid condition in persons with diabetes.

Lastly, we believe that passing this legislation will safeguard scarce health care dollars. As you are aware, health care costs have soared in the last decade. To keep costs under control, it is critical that only necessary tests are performed the right diagnosis reached. Health care dollars are wasted when trained physicians need to repeat poor quality studies performed by non-physicians, when incorrect treatment is prescribed based on an incorrect diagnosis, or when surgeries are conducted based on inaccurate electrodiagnostic studies.

The AANEM supports this legislation to ensure that Wisconsin residents receive the quality electrodiagnostic care and that scarce healthcare dollars are preserved. Thank you for allowing me this time to speak to you on why you should support Senate Bill 175.



Megan Fogelson, JD
Director of Health Policy



Timothy R. Dillingham, M.D., M.S.
Professor and Chair

December 14, 2007

Department of Physical
Medicine and Rehabilitation

Senator John Erpenbach
Chair, Committee on Health & Human Services
Room 8, State Capitol
P.O. Box 7883
Madison, WI 53707

Dear Senator Erpenbach,

At this time I am writing to submit my comments regarding SB 175, that covers the practice of electromyography and electrodiagnosis. I apologize for not appearing in person, but I am out of the country during your hearing yet wanted to provide information that supports my position that only physicians with adequate training and experience — namely neurologists and physiatrists — should be performing these tests.

I am the Chairman and Professor of Physical Medicine and Rehabilitation at the Medical College of Wisconsin. Prior to assuming this position, I served as associate professor of physical medicine and rehabilitation and director of the department's outpatient and electrodiagnostic services at the Johns Hopkins University School of Medicine. I am certified by the American Board of Physical Medicine and Rehabilitation, the American Board of Electrodiagnostic Medicine, and the National Board of Medical Examiners. From 1990 to 1994, I was a member of the U.S. Army, where I rose to the rank of Major and received the Army Commendation medal for promoting, directing, and improving the quality of research in the physical medicine service at Walter Reed Army Medical Center.

My current research interests include electrodiagnosis of patients with limb symptoms and musculoskeletal disorders. I have over 80 publications including 45 peer-reviewed papers. I, along with my colleagues, have recently published two papers that looked at the practice of electrodiagnostic medicine (Needle EMG and nerve conduction studies). Despite the fact that needle EMG and nerve conduction studies have been used to diagnose patients for over half a century, these two papers are the first to assess who performs these tests and the quality of performance by physicians versus non physicians.

Our first paper only described who performed electrodiagnostic tests and the costs.¹ No attempts were made to assess the quality of care provided to patients. While it is true that physical therapists billed less than physicians on average, it is impossible to extrapolate from this paper the cost effectiveness of the electrodiagnostic studies

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performed by physical therapists. The lower charge also does not mean that physical therapists charge less per study. The lower cost could be based on other factors such as the number of studies performed and on the type of studies performed. The study did not address that these patients often need to be retested at greater cost to the health care system. This need to retest is also painful to the patient. The paper also did not address care after the electrodiagnostic testing.

Our second investigation examined the effectiveness of care provided to patients. To assess the effectiveness of physicians versus non physicians such as physical therapists, we examined an important patient group, persons with diabetes.

In those persons with known diabetes who received needle EMG and nerve conduction studies, we examined how often physicians versus physical therapists stated that a patient had a diagnosis of polyneuropathy. Polyneuropathy is important to accurately diagnose because depending on the type of polyneuropathy, immediate intervention is necessary to avoid serious consequences for the patient and more costly future treatment. Since it can look like something as simple as carpal tunnel syndrome, it is easy for someone untrained (i.e., physical therapist or chiropractor) to miss.

In this second study², we examined 6,381 electrodiagnostic evaluations performed on patients with diabetes. Physical medicine and rehabilitation physicians, osteopathic physicians, and neurologists were very consistent and diagnosed the patients with polyneuropathy in identical percentages statistically (12.5%, 12.2%, and 11.9% respectively).

In contrast, Podiatrists and physical therapists recognized patients as having polyneuropathy only 2.4% and 2.1% respectively—rates about one-sixth that of physiatrists and neurologists despite controlling for differences in the types of patients seen. Chiropractors likewise failed to diagnose anyone with polyneuropathy. Nationwide, the nonphysician providers who did not diagnose polyneuropathy performed almost exclusively needle EMG testing (>90%).

In summary, this quality of care study demonstrated that nonphysicians underrecognized this important comorbid condition in persons with diabetes. In most cases they failed to perform sufficient testing to assess for this condition.

Currently no physical therapists are performing needle EMG in Wisconsin. I strongly urge the committee to assure that this continues in the future to ensure patients are accurately diagnosed.

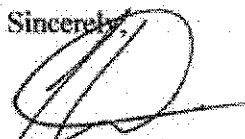
The study by me and my colleagues raises serious concerns about the quality of electrodiagnostic testing performed by nonphysician providers for persons with diabetes. Even though fewer tests appeared to be conducted by physical therapists

(and therefore fewer charges billed), the diagnoses were not accurate when compared to those of the physicians.

In summary, although physical therapists charge less overall for their electrodiagnostic evaluations, they fail to provide the quality of care that is provided by neurologists and physiatrists. The education and training that physicians receive allows them to provide the most cost effective needle EMG and nerve conduction studies that yield the most accurate results. I therefore urge you to protect quality patient care and to support making the performance and interpretation of needle EMG and electrodiagnostic medicine, the practice of medicine and oppose any efforts to add nonphysicians to the bill.

Thank you for your time and consideration of my viewpoints.

Sincerely,



Timothy R. Dillingham, MD
Professor and Chairman
Department of Physical Medicine and Rehabilitation

1. Dillingham TR, Pezzin LE, Rice B. Electrodiagnostic Services in the United States. *Muscle & Nerve*, Feb 1 2004;29:198-204.
2. Dillingham TR, Pezzin LE. Under-Recognition of Polyneuropathy in Persons with Diabetes by Non-Physician Electrodiagnostic Services Providers. *Amer J. of Phys. Med. Rehabil.* 2005 June;84(6):399-406.

**US News Top 24 PT Schools (Master's/Doctorate) **
Notice the lack of in depth course work regarding needle EMG.

University of Southern California

BKN 561 Independent Study in Electrophysiologic Measurement (PPDPT)
(4 Units) Methods of assessing muscle and nerve integrity with nerve conduction velocity and electromyographic techniques.

BKN 568ab Objective Measurement of Physical Performance (PPDPT)
(a: 3 Units; b: 3 Units) a: Instrumentation for clinical evaluation; to include measures of force, work, gait, motion, and kinesiology electromyography; elements of biophysics; and introduction to electronics. b: Instrumentation for clinical evaluation of cardiovascular, energy consumption, and respiratory system performance.

BKN 621 Electromyography in Research and Practice (DPT)
Physiology and electrophysiology of muscular contraction, how it is collected, quantified and processed. Uses of electromyographic information for research and clinical assessments.
Recommended preparation: human anatomy, skeletal muscle physiology.

No continuing ed in EMG.

Washington University (St. Louis)

Diagnosis and Management of Musculoskeletal Conditions in PT I (3) (DPT)
Diagnosis and Management of Musculoskeletal Conditions in PT II (3) (DPT)
Diagnosis and Management of Musculoskeletal Conditions in PT III (3) (DPT)
Diagnosis and Management of Neuromuscular Conditions in PT (4) (DPT)

No continuing ed in EMG.

University of Pittsburgh

Clinical Electrophysiology PT 2064 3 (DPT)
Musculoskeletal PT I/II/III (DPT)

No continuing ed in EMG.

University of Delaware

PHYT634 Electrotherapy: Provides an understanding of the physiological basis for the use of physical agents and electrotherapy. Emphasis placed on patient evaluation and clinical applications of modalities used in physical therapy clinics. 4 Hours (DPT)

MGH Institute of Health Professions

PH 850 CLINICAL NEUROANATOMY AND NEUROPHYSIOLOGY AND NEUROLOGY
Prerequisite: human physiology. Pass/Fail and audit available. The course emphasizes neuroanatomy and pathology of the membranes, synapses, peripheral/cranial nerves, neuropathic processes, autonomic nervous system, spinal column, and reflexes. Laboratory sessions

emphasize gross and surface anatomy of the nervous system, pathologic reactions and plasticity of the nervous system, electrophysiology and conduction velocities, and clinical examination of peripheral nerves. 3 Credits (MS)

US Army-Baylor University

PT 6104 Diagnostic Imaging & Procedures: 1 semester hour

An eclectic collection of topics related to issues in radiology and nuclear medicine. The emphasis is placed on musculoskeletal imaging with plain films, CT scans, and MRI. In addition instruction in medical laboratory diagnostic tests for physical therapists is provided. Lecture and laboratory work in electrophysiologic testing (EMG & NCV) is conducted. (DPT)

University of Iowa

101:295 (3 s.h.) APPLIED ELECTROMYOGRAPHY

To be offered spring semester of odd-numbered years. (MA, PhD)

Emory University

542. Neuroscience. (Neuroscience Basis of Physical Therapy)

Structure and function of the human nervous system with emphasis on a movement control model. Course includes human brain dissection labs. (DPT)

543c. Analysis of Dysfunction III. (Pathophysiology of Neurologic Disorders)

Pathophysiology and medical, surgical and pharmacological management of patients with neurologic conditions. Content congruent with Clinical Measures V(530e) to integrate the medical and physical therapist management of patients with these conditions. (DPT)

530e. Clinical Measures V. (Neurologic Physical Therapy)

Evidence-based physical therapist examination, diagnosis and management of adult and pediatric patients with neurological conditions. Content is integrated with pathophysiology and medical management of patients concurrently studied in Analysis of Dysfunction III. Includes congruent, weekly clinical education experiences and culminates in a two week, full-time clinical education experience. (DPT)

University of North Carolina-Chapel Hill

PHYT 230 KINESIOLOGY (3). Study of human movement including the functional aspects of the musculoskeletal and neuromuscular systems. Principles of biomechanics, functional anatomy, motor control, motor learning, and sociopsychological variables are used to analyze human movement. (MPT)

PHYT 284 NEUROMUSCULAR: PHYSICAL THERAPY INTERVENTION I (4). Basic principles of motor learning and motor control, the World Health Organization (WHO) health model, the neurological evaluation, and the specific treatment techniques of sensory input and proprioceptive neuromuscular facilitation are presented. Fall second year. (MPT)

PHYT 285 NEUROMUSCULAR: PHYSICAL THERAPY INTERVENTION II (3). This course provides the student with the theoretical, physiological, pathological, and behavioral basis for understanding common neurologic dysfunctions observed in adult and pediatric physical therapy. (MPT)

210 Muscle Mechanics And Electromyographic Kinesiology (2) (PhD in HMSC)

Duke University

PT-412. Neurological Practice Management II

This is the second part of a two semester/session course. This section continues focus on the management of children and adults with complex central nervous system (CNS) and multisystem disorders, and also will consider peripheral nervous system (PNS) and neuromuscular disease. Neuropathology, examination, evaluation, physical therapy diagnosis, prognosis, and intervention will be stressed. Neurodegenerative diseases (e.g. Parkinson's disease, amyotrophic lateral sclerosis, multiple sclerosis), spinal cord disorders (e.g. traumatic spinal cord injury, spinal bifida), peripheral neuromuscular diseases (e.g. muscular dystrophy, spinal muscular atrophy, Guillian Barre syndrome, peripheral nerve injury and degeneration), vestibular disorders, and balance disorders will be included. Use of nerve conduction velocity (NCV) and electromyography (EMG), availability and appropriate use of assistive devices, and use of aquatic therapy will be presented. Class discussion of contemporary research and panel discussion of clinical practice will be used to focus students attention on the undergirding principles of neurorehabilitation and their practical application. (DPT)

Northwestern University

ELECTROTHERAPY II - 533-2

Electrotherapy II examines the nerve and muscle stimulating currents for the purposes of muscle contraction. Topics include stimulation for improvement of strength, endurance, mobility and reduction of muscle tone to improve function, and maintenance of muscle contractility and nutrition. Emphasis is placed on selection of appropriate stimulation parameters to optimize the effectiveness of these treatment approaches. Electromyographic biofeedback for motor recruitment and inhibition is also included (DPT)

Temple University

571: Physical Therapy Diagnostics – 3 CH

This course reviews the principles of diagnosis and patient classification to guide physical therapy care. The patient classification scheme outlined in The Guide to Physical Therapist Practice practice patterns is presented as an example of diagnoses made by physical therapists. The course will also cover diagnostic decision-making, including measurement properties of various test and measures, in the following systems: musculoskeletal, neuromusculoskeletal, and cardiopulmonary. The required text for this course is APTA, Guide to Physical Therapist Practice, 2nd Ed, American Physical Therapy Association, Alexandria, VA, 2001. (DPT)

University of Miami (FL)

PTS542 Electrotherapy 3 credits - Hunt

Course provides an evaluation of nerve and skeletal muscle by classical electrical means. The therapeutic application of selected modalities is discussed. Prerequisite: For Physical Therapy majors only. (DPT)

UCSF/SFSU

Creighton University

PTD 448 Neuromuscular Physical Therapy I (DPT)
PTD 558 Neuromuscular Physical Therapy II (DPT)
NPT 526 Physical Assessment

This course focuses on the physical examination process in evaluation of the musculoskeletal, neuromuscular, cardiopulmonary, integumentary, GI/GU/renal and cognitive/behavioral systems. An on-site laboratory experience will provide practical, hands-on application of assessment skills in health examination of well adults. (Transitional DPT)

Marquette University

New York University

Electrotherapeutic Modalities - E44.2218

This course provides the student with an in-depth knowledge of electrotherapeutic modalities, including alternating, direct, and pulsed current (e.g. high voltage pulsed current stimulation, interferential current); neuromuscular electrical stimulation (NMES); functional electrical stimulation (FES); transcutaneous electrical nerve stimulation (TENS); iontophoresis; electrical muscle stimulation; and biofeedback. This course is designed to prepare students to select, apply, integrate, and critically evaluate the uses, limitations, indications, and contraindications of electrotherapeutic modalities and electrophysiological tests. (DPT)

recent graduates and their master's theses topics: Alummoottil, Rengitha - Comparison of Electromyographic Activity of Gastrocnemius and Soleus Muscles in Normal Healthy Individuals Walking in Flat Shoes and High Heel Shoes (MA)

Northern Arizona University

Topics in Neuromuscular Therapeutics (2) PT 735 (DPT)

University of Illinois-Chicago

PT 634 Neuromuscular Dysfunction II Medical, surgical, and physical therapy management of persons with acquired neurological dysfunction will be covered. Principles of motor learning, motor control, and life span motor development in the context of a disablement framework will be discussed. Laboratory: 4 Hours Per Week (DPT)

University of Indianapolis

PT 683 - Examination of and Intervention for Neuromuscular Conditions III.

This course presents advanced topics related to the examination and intervention of patients with neuromuscular dysfunction across the lifespan and continuum of care. Emphasis is placed on intervention techniques, communication/coordination of care and management of complex patients. Lecture, lab and case studies are used. (2 credit hours) (DPT)

University of Maryland-Baltimore

Neuromuscular I, Neuromuscular II (DPT)

Arcadia University

PT Examination/Evaluation Skills IV: Patient Management, Principles of Therapeutic Exercise, Cardiopulmonary Methods, Musculoskeletal Evaluation & Treatment, Orthotics & Prosthetics, Evaluation & Treatment of Nervous System Dysfunction, Electrophysiological Methods, Applied Anatomy & Biomechanics, Biomedical Instrumentation, Physical Modalities (DPT)

Simmons College

PT 735 Frameworks for Physical Therapy Practice: Neuromuscular 2

This course is a continuation of PT 734. Students expand their neuroscience knowledge and repertoire of physical therapy examination, evaluation, diagnosis, prognosis, and management skills for a broader variety of neuromuscular problems and more complex patient cases. Integrated clinical experiences are included. Teaching and learning methods include lecture, laboratory activities, patient cases, and small group self-directed, problem-based tutorials, and integrated clinical experiences. (6 credits) (DPT)



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*E*lectrodiagnosis

Needle EMG / NCV / Evoked Potentials

150 Hour Training Program

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C. Robert Humphreys, MS, DC, DACNB

Rand S. Swenson, DC, MD, PhD • David Radford, DC, DAAPM

CPT CODES

95860 Needle EMG

95900 NCV Motor, Each Nerve

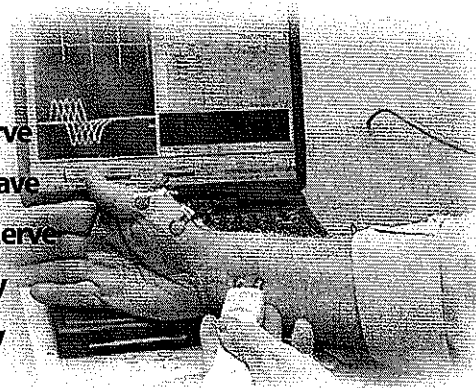
95903 NCV Motor with F Wave

95904 NCV Sensory, Each Nerve

95925 SEP Upper Extremity

95926 SEP Lower Extremity

95934 H-Reflex



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■ OVERVIEW - EDX

This program is designed to teach field practitioners how to perform and interpret Nerve Conduction Velocity (NCV), Needle Electromyography (EMG), Repetitive Stimulation and Evoked Potential (EP) studies.

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■ TIMES

Saturdays 1:00 pm - 7:30 pm

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Total program hours: 150

Please inquire if this program has been approved for CE hours in your state.

■ LOCATION

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200 East Roosevelt Road

Lombard, IL 60148

Janse Hall/Building D

www.nuhs.edu

■ PRACTITIONER FEES

- **\$395** Per session, registered and paid 7 days in advance of module.
 - **\$425** Per session, registered and paid within 7 days of module.
 - **\$3,995** Entire program paid in full by February 2, 2007
- * Enrollment is limited

■ REGISTRATION

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Lombard, IL 60148

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Fax completed registration form and payment information to:

630/889-6482

■ TELEPHONE

630/889-6622 or 6623

■ REQUIRED TEXTS

Please refer to EDX Syllabus available at EDX-1

■ INSTRUCTORS

C. Robert Humphreys, MS, DC, DACNB



- Master of Science, Kent State University
- Cum laude graduate of National College of Chiropractic
- Professor, NUHS
- Diplomate: American Chiropractic Neurology Board
- Consultant for electrodiagnostic testing and neurology in private practice

Rand S. Swenson, DC, MD, PhD



- Summa cum laude graduate of National College of Chiropractic
- MD with honors, University of Illinois, College of Medicine
- PhD, Anatomy, Loyola University
- Associate Professor, Dartmouth University Medical School
- Chair, Dept. of Anatomy, Dartmouth University Medical School

David Radford, DC, DAAPM



- Graduate of National College of Chiropractic
- Diplomate, American Academy of Pain Management
- Chief technical assistant to neurologist John P. Conomy, MD, JD, 1998 - 2001, Cleveland Clinic Health Systems
- Staff Member, Cleveland Orthopedic and Spine Hospital, Cleveland Clinic Health Systems.

IMPORTANT

Every attempt is made to offer this program as publicized. However, NUHS / Lincoln College reserves the right to adjust program dates, location, times, topic(s), faculty, tuition, etc. in order to accommodate for unexpected occurrences and to cancel due to insufficient enrollment. We will only notify advanced registrants of any cancellation or program changes. NUHS/Lincoln College is not responsible for any expenses incurred by registrants due to adjustments or cancellations. A \$35 processing fee will be charged for any tuition refund when the registrant provides written notice of cancellation at least (1) business day prior to the program date. After a program has been conducted as scheduled but the registrant did not attend nor provide a cancellation notice, tuition is non-refundable. A credit voucher may be requested within 30 days of the scheduled program date and can be applied toward another NUHS/Lincoln College program. All credit vouchers must be redeemed within 1 year of the scheduled program date or they will be forfeited.

Welcome to Dr Ferezy and Associates



NEUROLOGY PROGRAMS

Dr. Ferezy is the program coordinator and lead lecturer for the Neurology Diplomate Programs for Northwestern College of Chiropractic, New York Chiropractic College and Palmer Chiropractic University. He has been teaching Chiropractic Neurology programs for over 10 years.

Office Hours

M-W-F: 8am - 5:30pm

Weekends: By Appointment

Emergencies: Call (515) 440-2005

Dr Ferezy and Associates

Practice of Chiropractic Neurology and

Acupuncture

1441 29th Street, #100

West Des Moines, Iowa 50266

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**2008 Minimum Eligibility Requirements
for All Physical Therapist Specialist Certification Examinations**
(Cardiovascular & Pulmonary, Clinical Electrophysiologic,
Geriatric, Neurologic, Orthopaedic, Pediatric, Sports)

1. Licensure

Applicants must hold a current license to practice physical therapy in the United States or any of its possessions or territories.

2. Fee Schedule

Applicants are required to pay application review and examination fees. The application review fee is non-refundable. Upon payment of your application review fee, applicants will be provided with a copy of the *Description of Advanced Clinical Practice (DACP)* or *Description of Specialty Practice (DSP)* as well as the appropriate Self-Assessment Tool for Physical Therapists. Fees for the 2008 specialist certification examinations are as follows:

	APTA Member	Non-APTA Member	Payment Due
Application Review	\$500	\$845	July 31, 2007 w/application
Examination	\$800	\$1,525	November 8, 2007
Total Fees	\$1,300	\$2,370	

3. Application Deadline

The application deadline for the 2008 specialty examination is postmarked by July 31, 2007. Examinations will be administered at Prometric Testing Centers throughout the U.S. from February 23 – March 8, 2008.

4. Additional Minimum Eligibility Requirements by Specialty Area

Cardiovascular and Pulmonary

Advanced Cardiac Life Support Certification

Applicants must be currently certified in Advanced Cardiac Life Support (ACLS) by the American Heart Association.

Direct Patient Care

Applicants must submit evidence of 2,000 hours of direct patient care in the specialty area within the last ten (10) years. 25% (500) of which must have occurred within the last three (3) years. Direct patient care must include activities in each of the elements of patient/client management applicable to the specialty area and included in the *Description of Specialty Practice: Cardiovascular and Pulmonary Physical Therapy (DSP)*. These elements, as defined in the *Guide to Physical Therapist Practice*, are examination, evaluation, diagnosis, prognosis, and intervention.

Practice Settings

The Cardiovascular and Pulmonary Specialty Council recommends that direct patient care include patient/client management of individuals with a primary injury, disease, or other condition involving the cardiovascular and pulmonary systems in both acute and rehabilitation settings.

How specifically in needle EMG

Research

Applicants must submit written evidence of participation in a research process directly related to the specialty area within the last ten (10) years. This submission should be in the form of 1) a brief statement that describes your specific involvement, and 2) an abstract that summarizes the project in which you participated (written in standard form: e.g., purpose, methods, results, and conclusions.) Acceptable research processes include: single-subject studies, treatment efficacy studies (e.g., quality assurance or utilization review), surveys, and formal clinical trials.

Clinical Electrophysiologic

Direct Patient Care/ Electrophysiologic Testing

Applicants must submit evidence of 2,000 hours of direct patient care in the specialty area within the last ten (10) years. 25% (500) of which must have occurred within the last three (3) years. The applicant must include evidence of performing a minimum of 500 complete electroneuromyography examinations during those hours. The remainder of the patient hours may include observation of examinations and supervised examinations.

Direct patient care must include activities in each of the elements of patient/client management applicable to the specialty area and included in the *Description of Specialty Practice: Clinical Electrophysiologic Physical Therapy* (DSP). These elements, as defined in the *Guide to Physical Therapist Practice*, are examination, evaluation, diagnosis, prognosis, and intervention.

Clinical Education

Applicants must submit evidence of clinical education experience in electrophysiologic testing, preferably under the direct supervision of a clinical electrophysiologist who meets the requirements for specialist certification.

Patient Reports and Testing Logs

Applicants are required to submit actual patient reports that have been completed within the last three (3) years (from August 1, 2004). Submitted cases must be representative of abnormal findings and include one of each of the following: (1) a focal mononeuropathy involving a peripheral nerve; (2) a proximal level compromise, such as a radiculopathic or plexopathic process; and (3) a polyneuropathic process demonstrating that at least three extremities were sampled. Applicants will be required to submit copies of testing logs performed for a three month period after August 1, 2006.

Geriatrics

Direct Patient Care

Applicants must meet requirements for Option A or Option B.

Option A

Applicants must submit evidence of 2,000 hours of direct patient care in the specialty area within the last ten (10) years. 25% (500) of which must have occurred within the last three (3) years. Direct patient care must include activities in each of the elements of patient/client management applicable to the specialty area and included in the *Description of Advanced Clinical Practice: Geriatric Physical Therapy* (DACP). These elements, as defined in the *Guide to Physical Therapist Practice*, are examination, evaluation, diagnosis, prognosis, and intervention.

Option B

The applicant must submit evidence of 2,000 hours of direct patient care in the specialty area within the last ten (10) years, to include completion of an APTA-credentialed clinical residency in geriatric physical therapy.

Emergency Care and CPR

- A. The applicant must be currently certified in Cardiopulmonary Resuscitation (CPR) by completing the American Heart Association's BLS Healthcare Provider Course or the American Red Cross course CPR for the Professional Rescuer.
- B. The applicant must submit evidence of current first aid certification. Acceptable training includes the American Red Cross Emergency Response course, certification as an Emergency Medical Technician, Paramedic, or certification by the National Athletic Trainers Association as a Certified Athletic Trainer. Applicants may submit equivalent advanced level emergency care training (eg, course syllabus and description) to the Specialty Council for review. The Council will determine if the training meets this eligibility requirement.

5. **Application**

Applicants must describe their physical therapy practice experience for each position and facility on the appropriate forms in the application. Applicants must also chart their experience by year to ensure that they meet recency requirements. Applicants must document the number of direct patient care hours in the specialty.

6. **Applying for a Second Area of Certification**

Applicants must submit a complete set of application materials and fees for each specialist certification exam. ABPTS policy does not permit an applicant who applies for certification in a second specialty area to submit the same direct patient hours for more than one specialty area. Specialty councils will review previously submitted applications for duplication of hours. The ABPTS and specialty councils do not recommend that applicants apply in more than one specialty area during the same year.

7. **Examination**

The applicant must also sit for and pass a written examination which tests the application of advanced knowledge and clinical skills identified in the *Physical Therapy: Description of Advanced Clinical Practice (DACP)/Description of Specialty Practice (DSP)*. The DACP/DSP includes content related to the knowledge base for the specialty. Refer to the exam content outline included in the application and the DACP/DSP book for detailed information on the exam.

8. **Application Booklet**

The information booklet and application will be available by February 2007, and may be downloaded at no cost from APTA's Specialist Certification Department Website (www.apta.org/specialist_certification.) A print version of the information booklet and application will also be available by the end March, for a fee of \$15.

If you wish to purchase a copy by check, please mail the attached form to:

APTA
Accounting Department
Specialist Certification 2008 Information Booklet & Application
1111 North Fairfax Street
Alexandria, VA 22314-1488

If you would prefer to use your credit card to order a print copy of the application book, you may fax the attached form to APTA at 703/706-8186.

Description of Specialty Practice: Orthopaedic Physical Therapy (DSP). These elements, as defined in the *Guide to Physical Therapist Practice*, are examination, evaluation, diagnosis, prognosis, and intervention.

Option B

Applicants must submit evidence of successful completion of an APTA-credentialed post professional clinical residency that has a curriculum plan reflective of the *Description of Specialty Practice: Orthopaedic Physical Therapy (DSP)*. Experience from residencies in which the curriculum plan reflects only a portion of the DSP will not be considered.

Applicants who are currently enrolled in APTA-credentialed clinical residencies may apply for the specialist certification examination in the appropriate specialty area prior to completion of the clinical residency. These applicants will be conditionally approved to sit for the examination, as long as they meet all other eligibility requirements, pending submission of evidence of successful completion of the APTA-credentialed clinical residency to APTA's Specialist Certification Department, no later than one month before the examination window opens. The deadline for submitting this evidence is January 23, 2008 for the 2008 examination.

Pediatrics

Direct Patient Care

Applicants must submit evidence of 2,000 hours of direct patient care in the specialty area within the last ten (10) years. 25% (500) of which must have occurred within the last three (3) years. Direct patient care must include activities in each of the elements of patient/client management applicable to the specialty area and included in the *Description of Specialty Practice: Pediatric Physical Therapy (DSP)*. These elements, as defined in the *Guide to Physical Therapist Practice*, are examination, evaluation, diagnosis, prognosis, and intervention.

Sports

Direct Patient Care

In addition to meeting the CPR and Emergency Care Requirements, applicants must meet requirements for Option A or Option B. Direct patient care experience must include patient/client management of individuals with primary processes involving referral as the result of sports activity in **both** acute and rehabilitation settings.

Option A

Applicants must submit evidence of 2,000 hours of direct patient care in the specialty area within the last ten (10) years. 25% (500) of which must have occurred within the last three (3) years. Direct patient care must include activities in each of the elements of patient/client management applicable to the specialty area and included in the *Description of Specialty Practice: Sports Physical Therapy (DSP)*. These elements, as defined in the *Guide to Physical Therapist Practice*, are examination, evaluation, diagnosis, prognosis, and intervention.

Option B

Applicants must submit evidence of successful completion of an APTA-credentialed post professional clinical residency that has a curriculum plan reflective of the *Description of Specialty Practice: Sports Physical Therapy (DSP)* in sports physical therapy. Experience from residencies in which the curriculum plan reflects only a portion of the DSP will not be considered.

Applicants who are currently enrolled in APTA-credentialed clinical residencies may apply for the specialist certification examination in the appropriate specialty area prior to completion of the clinical residency. These applicants will be conditionally approved to sit for the examination, as long as they meet all other eligibility requirements, pending submission of evidence of successful completion of the APTA-credentialed clinical residency to APTA's Specialist Certification Department, no later than one month before the examination window opens. The deadline for submitting this evidence is January 23, 2008 for the 2008 examination.

Research

Applicants must submit written evidence of participation in a research process directly related to the specialty area within the last ten (10) years. This submission should be in the form of 1) a brief statement that describes your specific involvement, and 2) an abstract that summarizes the project in which you participated (written in standard form: e.g., purpose, methods, results, and conclusions.) Acceptable research processes include: single-subject studies, treatment efficacy studies (e.g., quality assurance or utilization review), surveys, and formal clinical trials.

Clinical Electrophysiologic

Direct Patient Care/ Electrophysiologic Testing

Applicants must submit evidence of 2,000 hours of direct patient care in the specialty area within the last ten (10) years. 25% (500) of which must have occurred within the last three (3) years. The applicant must include evidence of performing a minimum of 500 complete electroneuromyography examinations during those hours. The remainder of the patient hours may include observation of examinations and supervised examinations.

Direct patient care must include activities in each of the elements of patient/client management applicable to the specialty area and included in the *Description of Specialty Practice: Clinical Electrophysiologic Physical Therapy* (DSP). These elements, as defined in the *Guide to Physical Therapist Practice*, are examination, evaluation, diagnosis, prognosis, and intervention.

Clinical Education

Applicants must submit evidence of clinical education experience in electrophysiologic testing, preferably under the direct supervision of a clinical electrophysiologist who meets the requirements for specialist certification.

Patient Reports and Testing Logs

Applicants are required to submit actual patient reports that have been completed within the last three (3) years (from August 1, 2004). Submitted cases must be representative of abnormal findings and include one of each of the following: (1) a focal mononeuropathy involving a peripheral nerve; (2) a proximal level compromise, such as a radiculopathic or plexopathic process; and (3) a polyneuropathic process demonstrating that at least three extremities were sampled. Applicants will be required to submit copies of testing logs performed for a three month period after August 1, 2006.

Geriatrics

Direct Patient Care

Applicants must meet requirements for Option A or Option B.

Option A

Applicants must submit evidence of 2,000 hours of direct patient care in the specialty area within the last ten (10) years. 25% (500) of which must have occurred within the last three (3) years. Direct patient care must include activities in each of the elements of patient/client management applicable to the specialty area and included in the *Description of Advanced Clinical Practice: Geriatric Physical Therapy* (DACP). These elements, as defined in the *Guide to Physical Therapist Practice*, are examination, evaluation, diagnosis, prognosis, and intervention.

Option B

The applicant must submit evidence of 2,000 hours of direct patient care in the specialty area within the last ten (10) years, to include completion of an APTA-credentialed clinical residency in geriatric physical therapy.

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0894-9115/05/8406-0399/0
American Journal of Physical Medicine & Rehabilitation
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DOI: 10.1097/01.phm.0000163863.85719.6e

RESEARCH ARTICLE

Under-Recognition of Polyneuropathy in Persons with Diabetes by Nonphysician Electrodiagnostic Services Providers

Dillingham TR, Pezzin LE: Under-recognition of polyneuropathy in persons with diabetes by nonphysician electrodiagnostic services providers. *Am J Phys Med Rehabil* 2005;84:399–406.

Objective: Healthcare providers commonly refer patients to physiatrists and neurologists for electrodiagnostic testing when they have symptoms suggestive of a peripheral nerve disorder. Published practice guidelines specify that electrodiagnostic medicine consultants should possess special neurologic and procedural training in this area. We recently found that despite these practice guidelines, physical therapists, chiropractors, and podiatrists perform 17% of electrodiagnostic studies in the United States. These findings prompted the current investigation examining electrodiagnostic care across different providers for an important target population—persons with diabetes.

Design: A retrospective cohort of patients with diabetes who underwent electrodiagnostic testing in 1998 was identified in the MarketScan Commercial Claims & Encounters Database (The MEDSTAT Group) using CPT and ICD9CM codes. This database represents the healthcare claims for 16 million Americans in private and employer-based health plans. The outcome of interest was the rate of polyneuropathy identification across different providers, controlling for patient characteristics.

Results: There were 6381 electrodiagnostic encounters for persons with diabetes in 1998. Polyneuropathy identification rates were highest for physiatrists, osteopathic physicians, and neurologists (12.5%, 12.2%, and 11.9%, respectively). Podiatrists and physical therapists identified 2.4% and 2.1%, respectively, as having polyneuropathy—rates about one sixth that of physiatrists and neurologists despite controlling for casemix differences. Nonphysician providers who did not recognize polyneuropathy performed almost exclusively EMG testing (>90%) at the expense of nerve conduction studies.

Conclusions: This study raises concerns about the quality of electrodiagnostic testing by nonphysician providers for persons with diabetes. These results should prove useful for physicians, third-party payers, and health policy makers when confronting issues related to provision of electrodiagnostic services.

Key Words: Electrodiagnostic Services, Electromyography, Nerve Conduction, Physical Therapy, Chiropractor, Podiatrist, Polyneuropathy, Diabetes

Electrodiagnostic testing is a common diagnostic procedure used to evaluate patients with a wide variety of symptoms including pain, weakness, and numbness in a limb, and is generally provided by physiatrists and neurologists. This testing generally encompasses two components—nerve conduction studies and electromyography.

Evidence from a recent study suggests that, despite published guidelines for electrodiagnostic medicine consultants,¹⁻³ a substantial proportion of electrodiagnostic consultations in the United States are conducted by nonphysician providers.⁴ Using data from a large and nationally diverse sample of privately insured persons from the 1998 MarketScan Commercial Claims & Encounters Database, the authors found that nonphysician providers accounted for nearly one fifth of all electrodiagnostic encounters in that population. Among nonphysician providers, physical therapists were the dominant providers of electrodiagnostic services (9.3%), followed by podiatrists (5.5%).⁴ The study also uncovered significant differences in the extent of testing across provider types, with nonphysicians generally performing less extensive testing than their physician counterparts.⁴ The relatively large proportion of studies conducted by nonphysicians, combined with their relatively limited extent of testing, raised concerns about quality of care for these patients and prompted the current investigation. Extrapolating the MarketScan rates for electrodiagnostic testing to the United States population reveals that such services account for approximately a half-billion dollars in direct costs to the healthcare system. This does not include indirect costs for care resulting from the electrodiagnostic consultation such as surgical interventions for median nerve decompression when carpal tunnel syndrome is identified.

Diabetes mellitus is an important medical condition that is dramatically increasing in incidence and prevalence in the United States.⁵⁻¹⁰ The current epidemic has been fueled by earlier onset of diabetes in obese youth as well as an increasingly aged population that is living with diabetes. Diabetes is a leading cause of renal failure, retinopathy, and blindness, as well as peripheral vascular disease and atherosclerosis resulting in lower limb amputations, especially in minority and Native American populations.¹¹⁻¹⁵ A particularly prevalent comorbid condition for persons with diabetes, and one that often prompts electrodiagnostic consultation, is diabetic polyneuropathy.¹⁶⁻¹⁸ Painful diabetic polyneuropathy is a frequently disabling condition that requires accurate diagnosis through electrodiagnostic testing. Many medications successfully alleviate these symptoms, underscoring the importance of high-quality testing.¹⁶⁻¹⁸

The purpose of this investigation was to examine quality of electrodiagnostic care by different providers in persons with diabetes, using polyneuropathy as the indicator condition of interest. The importance of diabetic polyneuropathy, coupled with the current epidemic of diabetes in the United States, makes polyneuropathy suitable for use as a tracer condition with which to examine clinical care and outcomes for persons with diabetes undergoing electrodiagnostic testing.

METHODS

Data Source

Data for this analysis are drawn from the 1998 MarketScan Commercial Claims & Encounters Database (The MEDSTAT Group). The MarketScan database represents the inpatient and outpatient health care service use for over 16 million individuals nationwide who are covered by the benefit plans of large United States employers, health plans, and government and public organizations. The database links claims and encounter data to patient information across sites and types of providers, and over time. These data represent the medical experience of insured employees, early retirees, COBRA insurees, and Medicare-eligible retirees with employer-provided Medicare Supplemental plans, and their dependents. The annual medical database is constructed from data collected from over 50 large, generally self-insured individual employers, and includes private-sector health data from over 100 different insurance companies, including Blue Shield/Blue Cross plans, and third-party administrators. Both commercial claims and managed care encounters are included in the 1998 MarketScan database, which covers employees located in all 50 states, the District of Columbia, and Puerto Rico.

In addition to comprehensive utilization by provider type, service, and setting, the database includes demographic information (e.g., age, gender, state of residence) for all persons in the sample. The study was approved by the Johns Hopkins University and the Medical College of Wisconsin Institutional Review Boards.

Study Population and Definitions

Electrodiagnostic-related claims were identified by searching inpatient and outpatient claims files with the following CPT codes: 1) motor nerve conductions, CPT 95900 and 95903; 2) sensory nerve conductions, CPT 95904; 3) H-reflex testing, CPT 95934; 4) somatosensory-evoked potential testing, CPT 95925 and 95926; 5) repetitive nerve stimulation testing, CPT 95937; and 6) EMG testing, CPT 95860, 95861, 95863, 95864, 95867, 95868, 95869, 95870, and 95872.

The data structure of the MarketScan data was such that each individual component of the study (such as nerve conduction and EMG) was reflected by a separate claim. For instance, a provider might have submitted claims for motor and sensory nerve conduction studies and for electromyography, all performed during the same consultation. Because of this, all electrodiagnostic-related individual claims submitted by a single provider for the same patient on a given service date and with similar claim types (i.e., inpatient or outpatient) were combined into a single electrodiagnostic encounter or "episode" of care that reflected a complete electrodiagnostic consultation.

The sample was further restricted to electrodiagnostic studies among persons with diabetes. Patients were coded as having diabetes if any claim (electrodiagnostic-related or otherwise; inpatient or outpatient) during 1998 contained a diagnosis code for diabetes (ICD9CM; 250.0–250.9). It was assumed that if a person's claim contained the diagnosis of diabetes at anytime during the year, then that person was diabetic at the time of the electrodiagnostic encounter.

Data extracted from the MarketScan database captured patient sociodemographic status and electrodiagnostic encounter characteristics. Patient characteristics included age (yrs), gender, employment status (employed full time, part time, other), and geographic region of residence (Northeast, North Central, South, West). Electrodiagnostic characteristics included the number of studies per encounter and provider specialty. Provider specialty was mapped from carrier specific coding to MarketScan's standard values and, as a first step, classified into one of ten groups: Physical Medicine and Rehabilitation (physiatry); Neurology; Orthopedic Surgery; Family Practice and Internal Medicine; Podiatry; Osteopathic Care; Chiropractic; Physical Therapy; Physician, specialty unidentified; and Facility, provider unspecified (e.g., "acute care hospitals," "outpatient centers," "rehabilitation facilities"). Claims grouped in the category of "physician, specialty unidentified" were then examined in depth and, whenever appropriate, were reclassified into one of the five main physician provider groups.

To assess and control for casemix across providers, comorbidity information was collected from healthcare claims for an individual over the full year.¹⁹ The MarketScan database contained unique patient identifiers that allowed us to link all 1998 claims for patients across all episodes of service use during that year, including inpatient and outpatient visits and admissions. For persons selected as having an electrodiagnostic study and an ICD9 code for diabetes, we examined all inpatient and outpatient claims for the presence of other comor-

bidity. The type of comorbidity (e.g., peripheral vascular disease, heart disease, cancer) as well as the number of comorbidities not including diabetes, were used in multivariate analyses to determine their influences on identification of polyneuropathy across different providers. The goal was to casemix-adjust the diagnostic identification rates for polyneuropathy across all providers.¹⁹

Polyneuropathy at each electrodiagnostic encounter was identified by examining the two diagnostic codes available for each study in an episode of care. A diabetic patient was coded as having been diagnosed with polyneuropathy during an electrodiagnostic encounter if any studies (claims) associated with that episode had an ICD9CM code of 356.9, 356.4, 357.0, or 357.2. These codes included persons with diabetic polyneuropathy as well as those with idiopathic polyneuropathy, acute infectious polyneuropathy, and unspecified polyneuropathy. The latter ICD9CM diagnosis codes were included to capture those persons with diabetes who had a polyneuropathy, recognizing that other diagnostic tests are required to precisely identify the etiology of an underlying polyneuropathy.

Statistical Analyses

Electrodiagnostic encounters of persons with diabetes were contrasted across provider specialty groups by patient's health and sociodemographic characteristics using univariate (t and χ^2) test statistics. Nonparametric (Mann Whitney) test statistics were used to examine variation in non-normal characteristics of electrodiagnostic encounters, such as number of claims, across providers. To determine the independent effect of provider specialty on the probability of making a diagnosis of polyneuropathy during electrodiagnostic consultations for diabetic persons, we relied on multivariate techniques. Specifically, a probit specification was used to examine factors affecting the likelihood that a diagnosis was made. All data analyses were conducted using Stata 7.0 statistical software. Unless otherwise noted, only differences that were statistically significant at a P level less than 0.05 are discussed in the text.

RESULTS

There were 6381 electrodiagnostic encounters (consultations) for persons with diabetes in the MarketScan database, corresponding to 13.2% of all electrodiagnostic encounters among this privately insured population in 1998. Table 1 presents the distribution of electrodiagnostic encounters for persons with diabetes by provider specialty, according to sociodemographic and health characteristics of the patients. The mean age of diabetic persons receiving electrodiagnostic services was 51 yrs old. About two fifths of all encounters served male

TABLE 1 Distribution of electrodiagnostic encounters among persons with diabetes by provider specialty, according to selected diagnosis and sociodemographic characteristics of the patients

Patient Characteristics	Provider Specialty										
	Physician Providers					Nonphysician Providers					
	Neurologist (n = 1587)	Physiatrist (n = 1626)	Physician, Unspecified (n = 598)	Family/Int. Medicine (n = 360)	Orthopedic Surgeon (n = 79)	Osteopathic Physician (n = 49)	Physical Therapist (n = 423)	Chiropractor (n = 51)	Podiatrist (n = 246)	Facility (n = 1362)	Total (n = 6381)
Percent Distribution											
Male	39.7	38.1	37.8	43.1	53.2	30.6	38.8	49.0	43.5	40.3	39.7
Age group											
0-34	5.0	4.9	5.4	5.3	3.8	8.2	7.1	5.9	10.5	8.2	6.1
35-44	12.3	11.2	17.4	8.3	21.5	14.3	15.6	3.9	13.4	14.8	13.1
45-54	39.9	36.5	36.0	32.8	35.4	42.8	40.7	43.1	39.0	33.1	36.8
55-64	42.4	47.2	40.0	53.6	38.0	34.7	36.4	47.1	36.2	43.0	43.5
65 and older	0.4	0.1	1.3	0.0	1.3	0.0	0.2	0.0	0.8	0.8	0.5
Comorbidities	1.5	1.7	1.4	1.7	1.5	1.1	1.2	1.1	1.1	1.4	1.5
Employment status											
Full time	71.8	60.3	69.7	56.7	70.9	71.4	75.2	80.4	76.4	67.5	67.4
Part time	23.2	36.0	23.8	40.3	25.3	16.3	20.8	15.7	21.1	26.4	27.8
Not in labor market	5.0	3.7	6.5	3.1	3.8	12.2	4.0	3.9	2.4	6.1	4.8
Managed care	41.9	36.8	30.6	43.6	30.4	16.3	33.8	37.2	27.2	35.5	36.8
Region											
Northeast	13.3	11.4	26.9	23.9	13.9	2.0	15.4	21.6	9.3	17.1	15.5
North Central	11.1	60.8	7.4	17.8	12.7	46.9	22.5	17.6	6.5	38.9	30.7
South	61.8	21.0	52.3	47.0	57.0	20.4	53.2	52.9	28.4	33.9	41.4
West	11.2	6.0	7.2	9.2	12.7	16.3	7.3	7.8	48.4	6.6	9.6

patients (39.7%), and slightly over two thirds of them were for services to patients working full time. Overall, 36.8% of all encounters were covered by managed care plans.

Relative to psychiatrists and neurologists, non-physician providers—most notably, podiatrists and physical therapists—tended to serve a slightly younger population. On average, patients served by these providers were 3 yrs younger than those treated by neurologists and psychiatrists (49 *vs.* 52 yrs old, respectively, $P < 0.05$). It is important to remember that elderly, Medicare eligible persons are not included in the MarketScan database, only those in private health plans. The mean number of comorbidities (exclusive of diabetes) among patients receiving electrodiagnostic services from nonphysician providers was 1.1 compared with 1.6 ($P < 0.05$) among physician providers.

Table 2 presents unadjusted and adjusted rates of identification of polyneuropathy by provider specialty. Unadjusted polyneuropathy identification rates were highest among psychiatrists, osteopathic physicians, and neurologists (12.5%, 12.2%, and 11.9%, respectively). Podiatrists and physical therapists identified 2.4% and 2.1%, respectively, of all diabetic patients undergoing electrodiagnostic testing as having polyneuropathy—a rate about one sixth of that of psychiatrists and neurologists. Chiropractors and orthopedic surgeons provided electrodiagnostic services to relatively small numbers of diabetic persons, yet did not identify any of those patients as having polyneuropathy.

The adjusted identification rates, shown in the last column of Table 2, are essentially identical to the raw identification percentages discussed above. These probabilities, which have been adjusted for a wide array of factors capturing variation across patients in dimensions that might have confounded the relationship between provider specialty and the probability of being diagnosed with polyneuropathy, reveal that the marginal effects of provider specialty on the probability of making the diagnosis are essentially unaffected by the inclusion of controls for patient's age, gender, presence of comorbid conditions, work status, and geographic region of residence. Among physician providers, there were no differences in the probability of diagnosing a polyneuropathy among neurologists, psychiatrists or osteopathic physicians. Type of provider was the only factor that influenced polyneuropathy identification.

Table 3 presents mean and standard deviations for individual tests (claims) per electrodiagnostic consultation. The mean number of studies per encounter performed by physician providers was 3.7, higher than that for nonphysician providers (2.9, $P < 0.001$) in the group with polyneuropathy. Psychiatrists and neurologists exhibited similar patterns of testing, each performing about 3.5 studies per encounter. Physical therapists performed the lowest number of studies per consultation overall (2.9). There were no statistically significant differences among neurologists and psychiatrists in the extent of testing across patients ultimately found to

TABLE 2 Provider-specific polyneuropathy identification rates and adjusted probabilities among diabetic patients

Provider Specialty	Number of Diabetic Patients	Percent with Polyneuropathy	Adjusted Probability
Physician providers			
Neurologist (reference group)	1587	11.9	11.6
Psychiatrist	1626	12.5	12.7 [$P=0.82$]
MD/physician unspecified	598	11.7	10.9 [$P=0.67$]
Family practice/internal medicine	360	8.1	7.1 [$P=0.01$]
Orthopedic surgeon	79	0.0	a
Osteopathic physician	49	12.2	12.3 [$P=0.72$]
Nonphysician providers			
Physical therapist	423	2.1	2.2 [$P=0.00$]
Chiropractor	51	0.0	a
Podiatrist	246	2.4	2.8 [$P=0.00$]
Facility	1362	7.2	7.1 [$P=0.00$]

Note: Numbers in brackets are P values. The sample consists of 6381 electrodiagnostic encounters for persons with diabetes. Adjusted probabilities are calculated at the individual level (then averaged over the entire sample) by applying parameter estimates obtained from multivariate Probit regressions that control for provider specialty and patient's gender, age, employment status, union status, beneficiary status (self *vs.* dependent), health plan type (managed care *vs.* traditional indemnity), number of comorbidities, and region of residence. Individual-level predicted probabilities are obtained by assuming all persons in the sample were seen by a given provider type (e.g., Neurologist) while maintaining all other factors constant at their original values.

a = Provider specialty contributed no variation to the dependent variable, i.e., provider specialty with zero diagnoses of polyneuropathy.

TABLE 3 Number of claims per electrodiagnostic encounter for persons with diabetes, by provider specialty and diagnosis of polyneuropathy

Provider Specialty	With Polyneuropathy				Without Polyneuropathy			
	Mean Number of Studies (SD)	Percentage of Studies by Provider Group¶			Mean Number of Studies (SD)	Percentage of Studies by Provider Group¶		
		Motor	Sensory	EMG		Motor	Sensory	EMG
Physician Providers	3.7* (2.3)				3.1 (2.1)			
Neurologist	3.5 (1.7)	44.7	27.9	27.4	3.1 (1.6)	34.5	28.3	37.1
Physiatrist	3.3 (2.1)	39.7	26.5	33.8	3.0 (1.6)	34.2	26.7	39.1
MD/physician unspecified	5.8*† (5.1)	36.7	27.9	35.3	3.8† (3.3)	29.2	25.1	45.6
Family/internal medicine	3.2* (2.3)	39.2	39.3	21.4	2.1† (2.1)	12.6	22.3	65.0
Orthopedic surgeon	a	a	a	a	2.3† (1.9)	34.2	19.0	46.8
Osteopathic physician	3.8* (1.2)	16.7	33.3	50.0	3.3 (1.7)	27.9	23.2	48.8
Nonphysician providers	2.9*† (1.6)				1.5 (1.1)			
Physical therapist	2.9*† (1.0)	22.2	22.2	55.5	1.4† (1.0)	5.1	4.1	90.8
Chiropractor	a	a	a	a	1.4† (1.6)	5.9	3.9	90.2
Podiatrist	3.2*† (1.3)	0	66.7	33.3	1.8† (0.8)	0.8	5.8	93.3
Facility	3.4* (2.2)				2.4† (1.8)			

*Differences in mean claims per encounter between those with and without a diagnosis of polyneuropathy are statistically significant at the $P < 0.05$ level.

†Differences in mean claims per encounter between specific provider and neurologist (reference category) are statistically significant at the $P < 0.05$ level.

a = Provider specialty with zero diagnoses of polyneuropathy.

¶These percentages refer to proportions of the total number of individual tests (nerve conduction studies and EMG) done by the entire group of providers across the two groups of patients—those with polyneuropathy and those without polyneuropathy.

have polyneuropathy (3.5 and 3.3, respectively) and patients without polyneuropathy (3.1 and 3.0, respectively), indicating that similar examination and testing procedures were followed for both groups of patients. In contrast, physical therapists and podiatrists performed nearly twice the number of studies on patients they diagnosed with polyneuropathy relative to testing conducted on patients with diabetes whom they did not diagnose with polyneuropathy (2.9 vs. 1.4 for physical therapists and 3.2 vs. 1.8 for podiatrists, respectively).

In addition to differences in the extent of testing, we also observed marked differences across providers in the type of studies performed. Table 3 shows the percentage of studies that were motor nerve conduction studies, sensory nerve conduction studies, and needle EMG tests. The figures represent the average number and proportion of studies by type of tests performed for each provider group. Among physicians, the patterns of motor, sensory, and EMG testing were roughly similar across the polyneuropathy and nonpolyneuropathy patient groups, with all patients receiving approximately the same comprehensive testing of the motor and sensory peripheral nerves. In contrast, types of testing across patient groups differed substantially among nonphysician providers. Among physical therapists, for example, 22.2% of studies performed in persons diagnosed with a polyneuropathy were motor nerve conduction studies, another 22.2% were sensory

nerve conduction studies, and the remaining 55.5% were needle EMGs. For persons not diagnosed with a polyneuropathy, however, 90.8% of the studies performed by physical therapists involved only EMG testing. This failure to examine motor and sensory nerves by nerve conduction likely contributed to the under-recognition of polyneuropathy by these providers. Among podiatrists, two thirds of all EDX studies performed in persons ultimately diagnosed with polyneuropathy were sensory nerve conduction studies and one third were needle EMGs, and there were no motor conduction studies. As with physical therapists, however, needle EMGs comprised most (93.3%) of all the studies performed in persons without a polyneuropathy diagnosis.

DISCUSSION

This study examined patterns of electrodiagnostic testing across different provider specialties. In particular, it focused on physician and nonphysician providers' ability to identify a complex condition—polyneuropathy—among persons with diabetes. Using claims data available for a large and diverse sample of employees and their dependents, the probability of recognizing polyneuropathy among physiatrists and neurologists was nearly 6-fold that of nonphysician providers and orthopedists. Demographic and health differences across groups of patients seen by these different providers

could not explain the 6-fold differences in recognizing polyneuropathy. Relative to physician providers, nonphysician providers tended to conduct significantly less extensive testing, a practice pattern that, in combination with less awareness of polyneuropathy as an important comorbidity in patients with diabetes, likely contributed to their observed under-recognition of diabetic polyneuropathy. Furthermore, nonphysician providers rarely performed motor or sensory nerve conduction studies, a finding that likely contributed to the low rate of recognition of polyneuropathy among their diabetic patients. Adjusted identification rates indicated that the observed differences across provider specialties were not attributable to casemix differences.

A growing body of literature has begun to examine the division of labor between physicians and nonphysician providers. Physicians are viewed as the highest skilled practitioners, able to handle the most complex patients. They delegate to other healthcare professionals care tasks that are less complex or less demanding of knowledge and skill.²⁰ State licensing authorities often recognize this distinction, but have come under increasing pressure from professional advocacy groups to expand the provision of medical services and scope of practice for nonphysician professionals to perform care traditionally reserved for physicians.^{21,22} Although physicians and patients can benefit from appropriate use of such physician extenders, quality information is necessary to fully inform the decisions regarding who is qualified to practice in specific areas of medicine.

Our findings raise concerns about nonphysician providers (physical therapists, podiatrists, and chiropractors), as well as physician providers with less neurologic and electrodiagnostic training than physiatrists and neurologists (most notably, orthopedists, family practice physicians, and internists) engaging in the practice of electrodiagnostic medicine. The steep rise in the incidence of diabetes in the past two decades, combined with recent evidence of earlier onset of the disease, especially among minority populations, highlight the importance of providing timely, high-quality, electrodiagnostic services to persons at risk for diabetes-related secondary conditions such as polyneuropathy.^{5-7,12} Patients with diabetes with painful polyneuropathy, who are not accurately diagnosed with this condition through electrodiagnostic testing, not only fail to receive appropriate medications for their pain, but run the risk of inappropriate surgical interventions for misdiagnosed entrapment neuropathies and radiculopathies.

Physician specialties for whom electrodiagnostic medicine constitutes only a small component of professional practice—most notably, orthopedists,

family practitioners, and internists—were also significantly less likely than physiatrists and neurologists to identify polyneuropathy in diabetic patients. Osteopathic physicians, on the other hand, exhibited similar identification rates to those of neurologists and physiatrists. It is likely that the professional specialty code designation of osteopathic physician was used for claims purposes instead of physiatry or neurology codes reflecting their specialty areas of practice. We are unable to determine the specialty of providers in facilities, yet because a large number of studies were performed in this setting, it was appropriate to include such designation to provide a complete picture of electrodiagnostic services provision.

The concordance of physiatrists and neurologists in identifying polyneuropathy in this large national sample with demonstrated similar patterns of testing across groups suggests that these specialists, with substantial education and training in peripheral neurologic diseases, are rendering similar care. Both physiatrists and neurologists demonstrated comprehensive testing that assessed both motor and sensory peripheral nerves, and reached similar study conclusions. Because of the large number of patients seen by physiatrists and neurologists, as well as their identical rates of recognition, it is reasonable to consider these rates of polyneuropathy identification the best estimates for the true prevalence of electrodiagnostically confirmed polyneuropathy among nonelderly diabetic patients receiving electrodiagnostic services in the United States.

The MarketScan database provided a unique opportunity to examine electrodiagnostic services in a large national sample of persons with diabetes. An important limitation of this study, however, was the focus on privately insured persons employed by large firms that contribute data to the MarketScan database. The experiences of uninsured persons, as well as those of persons insured through public programs such as Medicare, Medicaid, and the Veterans Administration, are not represented in the data. A prospective study would be necessary to fully confirm whether there were any systematic differences in patient symptoms, physical examination signs, or severity and duration of diabetes that might explain the differences in diagnostic rates between physiatrists and neurologists, and other nonphysician and physician practitioners with different study outcomes (diagnoses). It is unlikely that such differences in clinical presentations would, however, fully explain 6-fold differences in diagnostic rates for a group of nonelderly persons with diabetes.

An important limitation regarding the generalizability of our findings relates to the fact that the MarketScan data reflected a younger population of privately insured persons. These findings do not directly apply to older patients. Studies focus-

ing on the quality of electrodiagnostic services received by the growing number of older adults are vital, as elderly persons likely use electrodiagnostic resources more intensively than did the younger group examined here.

The AAEM guidelines in electrodiagnostic medicine, published in 1999,²³ present the best practice recommendations, derived from the scientific literature as well as expert opinion, for assessing persons suspected of polyneuropathy. According to those guidelines, adequate diagnosis of polyneuropathy requires that motor and sensory nerve conduction be performed in at least two limbs (e.g., four studies), and that EMG studies be performed in at least one distal muscle in both legs and an upper limb.²³ Findings from examinations of electrodiagnostic testing by provider (shown in Table 3) indicate that nonphysicians fall short in their performance of sensory and motor nerve conduction testing, particularly among diabetic patients in whom they did not diagnose polyneuropathy. Further, the scope of testing by nonphysician providers differed substantially from the testing performed by physicians. In fact, among patients without polyneuropathy, nonphysicians performed needle EMG almost exclusively at the expense of motor or sensory nerve testing. Such a reliance on EMG, without the requisite nerve conduction studies, may have contributed to the low rate of polyneuropathy recognition among nonphysician providers.

CONCLUSION

Recognition of polyneuropathy in nonelderly diabetic persons referred for electrodiagnostic testing is an important aspect of high-quality health-care, particularly in view of rising rates of diabetes, and the disabling nature of painful diabetic polyneuropathy. Physical therapists, chiropractors, and podiatrists who perform electrodiagnostic testing, identified polyneuropathy in persons with diabetes at a rate about one sixth that of physiatrists and neurologists despite casemix adjustment. Other physician groups—orthopedists, family practitioners, and internists—demonstrated significantly lower rates of polyneuropathy identification as well. Underutilization of nerve conduction testing by nonphysicians likely contributed to these differences recognizing polyneuropathy.

Future investigations are necessary to fully interpret and confirm these findings. However, the results of this study should prove useful for physicians, insurers, and health policy makers when confronting issues related to electrodiagnostic services provision in the United States.

REFERENCES

1. American Association of Electrodiagnostic Medicine: Guidelines in electrodiagnostic medicine: The scope of electrodiagnostic medicine. *Muscle Nerve* 1999;8 (suppl);S3-S12
2. American Association of Electrodiagnostic Medicine: Guidelines for establishing a quality assurance program in an electrodiagnostic laboratory. *Muscle Nerve* 1999;8 (suppl);S33-S39
3. American Association of Electrodiagnostic Medicine: Educational guidelines for electrodiagnostic training programs. *Muscle Nerve* 1999;8 (suppl);S13-S15
4. Dillingham TR, Pezzin LE, Rice JB: Electrodiagnostic services in the United States. *Muscle and Nerve* 2004;29:198-204
5. Harris MI: Diabetes in America: Epidemiology and scope of the problem. *Diabetes Care* 1998;21 (suppl 3): C11-C14
6. Harris MI, Flegal KM, Cowie CC, Eberhardt MS, Goldstein DE, Little RR, et al: Prevalence of diabetes, impaired fasting glucose, and impaired glucose tolerance in U.S. adults. *The Third National Health and Nutrition Examination Survey, 1988-1994 [see comments]*. *Diabetes Care* 1998;21 (4):518-524
7. McNabb W, Quinn M, Tobian J: Diabetes in African American women: the silent epidemic. *Womens Health* 1997;3 (3-4):275-300
8. Rosenbloom AL, Joe JR, Young RS, Winter WE: Emerging epidemic of type 2 diabetes in youth. *Diabetes Care* 1999 Feb;22 (2):345-54
9. Schraer CD, Bulkow LR, Murphy NJ, Lanier AP: Diabetes prevalence, incidence, and complications among Alaska Natives, 1987. *Diabetes Care* 1993;16 (1):257-259
10. James SA, Jamjoum L, Raghunathan TE, Strogatz DS, Furth ED, Khazanie PG: Physical activity and NIDDM in African-Americans: The Pitt County Study. *Diabetes Care* 1998;21 (4):555-562
11. Lavery LA, Ashry HR, van Houtum W, Pugh JA, Harkless LB, Basu S: Variation in the incidence and proportion of diabetes-related amputations in minorities. *Diabetes Care* 1996;19 (1):48-52
12. Lavery LA, van Houtum WH, Ashry HR, Armstrong DG, Pugh JA: Diabetes-related lower-extremity amputations disproportionately affect Blacks and Mexican Americans. *South Med J* 1999;92 (6):593-599
13. Lehto S, Ronnema T, Pyorala K, Laakso M: Risk factors predicting lower extremity amputations in patients with NIDDM. *Diabetes Care* 1996;19 (6):607-612
14. Most RS, Sinnock P: The epidemiology of lower extremity amputations in diabetic individuals. *Diabetes Care* 1983;6 (1):87-91
15. Valway SE, Linkins RW, Gohdes DM: Epidemiology of lower-extremity amputations in the Indian Health Service, 1982-1987. *Diabetes Care* 1993;16 (1):349-353
16. Dumitru D: Generalized peripheral neuropathies. In *Electrodiagnostic Medicine*, Philadelphia: Hanley and Belfus, 1995
17. Adler AI, Boyko EJ, Ahroni JH, Smith DG: Lower-extremity amputation in diabetes. The independent effects of peripheral vascular disease, sensory neuropathy, and foot ulcers. *Diabetes Care* 1999;22 (7):1029-1035
18. Sindrup SH, Jensen TS: Pharmacologic treatment of pain in polyneuropathy. *Neurology* Oct 2000;55:915-920
19. Deyo RA, Taylor VM, Diehr P, Conrad D, Cherkin DC, Ciol M: Analysis of automated administrative and survey databases to study patterns and outcomes of care. *Spine* 1994; 19(18 Suppl):2083S-2091S
20. Abbott AD: *The System of Professions: An Essay on the Division of Expert Labor*. Chicago: University of Chicago Press, 1988
21. Cooper RA, McKee HJ: Chiropractic in the United States: Trends and issues. *Milbank Quarterly* 2003;81 (1):107-38
22. Cooper RA, Henderson T, Dietrich CL: Roles of nonphysician clinicians as autonomous providers of patient care. *JAMA* 1998;280:795-802
23. American Association of Electrodiagnostic Medicine: Guidelines in electrodiagnostic medicine: The electrodiagnostic medicine consultation. *Muscle Nerve* 1999;8 (suppl): S73-S108